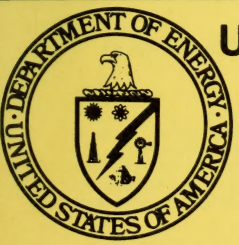
SOLAR/1030-78/12

Monthly Performance Report

CHESTER WEST

DECEMBER 1978



U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

MONTHLY PERFORMANCE REPORT

CHESTER WEST

DECEMBER 1978

I. SYSTEM DESCRIPTION

The Chester West site is a single-family residence in Huntsville, Alabama. Solar energy is used for space heating the home and preheating domestic hot water (DHW). The solar energy system has an array of flat-plate collectors with a gross area of 225 square feet. The array faces south at an angle of 49 degrees to the horizontal. A glycerol-water solution is used as the medium for delivering solar energy from the collector array to storage, and water is the medium for delivering solar energy from storage to the space heating and hot water loads. Solar energy is stored aboveground in a 500-gallon water storage tank. Auxiliary space heating is provided by an air-to-air heat pump and electrical heating elements which are designed to function in parallel with the solar energy space heating loop. Auxiliary hot water heating is provided in series with the solar energy hot water heating loop through the use of electrical heating elements in an 80-gallon DHW tank. The system, shown schematically in Figure 1, has three modes of solar operation.

Mode 1 - Collector-to-Storage: This mode activates when the control system senses a sufficient temperature difference between the collector and storage and remains active until the temperature difference drops below the accepted minimum. The collected energy is transferred to storage through a ring-type, liquid-to-liquid heat exchanger located in the storage tank. Pump P1 is operating.

Mode 2 - Storage-to-Space Heating: This mode activates when there is a demand for space heating. Solar energy is circulated to the conditioned space by solar heated water from storage through a liquid-to-air heat exchanger located in the air-distribution duct. Pump P3 is operating.

Mode 3 - Storage-to-DHW Tank: This mode activates when the control system senses a sufficient temperature difference between storage and the DHW tank, and remains active as long as a sufficient difference exists. Water circulates from the top of storage through a liquid-to-liquid heat exchanger located in the bottom of the DHW tank. Pump P2 is operating.

II. PERFORMANCE EVALUATION

INTRODUCTION

The solar energy system was in continuous operation during the month of December. Instrumentation anomalies in the form of malfunctioning liquid flowmeters (W300 and W400) in the storage/DHW and storage/space heating loops affected the December analysis. It was possible to preserve the space heating performance data by basing performance analysis on air rather than liquid flow.

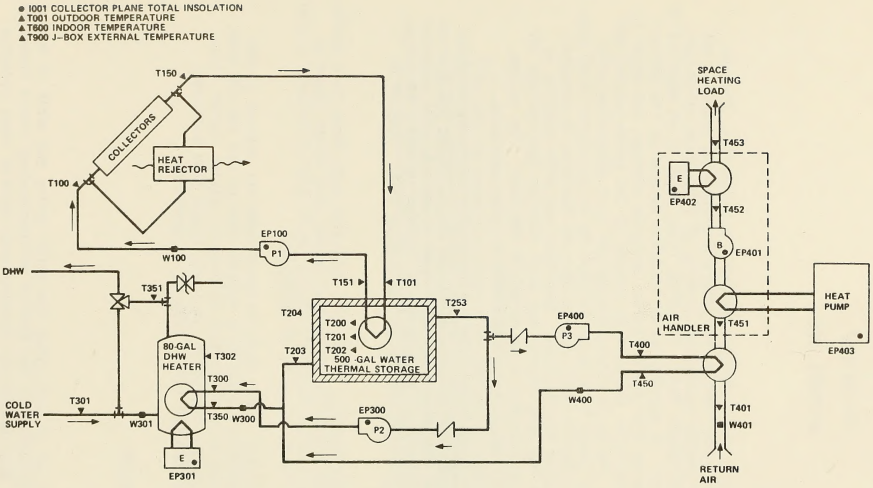


Figure 1. CHESTER WEST SOLAR ENERGY SYSTEM SCHEMATIC

This was not possible in the DHW loop. Some storage and DHW performance factors were rendered invalid. Data on the space heating component indicates a solar fraction of 19 percent, and an electrical energy savings of 0.55 million Btu.

WEATHER CONDITIONS

During the month, total incident solar energy on the collector array was 8.0 million Btu for a daily average of 1149 Btu per square foot. This was above the estimated average daily solar radiation for this geographical area during December of 1066 Btu per square foot for a south-facing plane with a tilt of 49 degrees to the horizontal. The average ambient temperature during December was 45°F as compared with the long-term average for December of 42°F.

THERMAL PERFORMANCE

Collector - The total incident solar radiation on the collector array for the month of December was 8.0 million Btu. During the period the collector loop was operating, the total insolation amounted to 7.2 million Btu. The total collected solar energy for the month of December was 3.8 million Btu, resulting in a collector array efficiency of 48 percent, based on total incident insolation. Solar energy delivered from the collector array to storage was 3.5 million Btu. Energy loss during transfer from the collector array to storage was 0.3 million Btu.

Storage - Solar energy delivered to storage from the collector was 3.5 million Btu. The average storage temperature for the month was 96°F.

DHW Load - The DHW subsystem consumed an unknown amount of solar energy and 0.46 million Btu of auxiliary electrical energy. The DHW subsystem consumed a total of 0.18 million Btu of operating energy.

Space Heating Load - The space heating subsystem consumed 1.2 million Btu of solar energy and 5.1 million Btu of auxiliary electrical energy to satisfy a space heating load of 6.1 million Btu. The solar fraction of this load was 19 percent. The space heating subsystem consumed a total of 0.51 million Btu of operating energy, resulting in an electrical energy savings of 0.55 million Btu.

OBSERVATIONS

The evaluation of the DHW and storage solar subsystems was limited by a malfunctioning liquid flowmeter. Two system problems need correction: The slow liquid seepage from the storage tank and the lengthy operation of the pump in the DHW loop.

ENERGY SAVINGS

The space heating subsystem contributed an electrical savings of 0.55 million Btu.

III. ACTION STATUS

Plans have been made to replace the storage tank. The system designer is investigating pump operation in the DHW loop. The operation of the liquid flow sensors are to be investigated by Boeing during the next site visit.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: CHESTER WEST
REPORT PERIOD: DECEMBER,1978

SOLAR/1030-78/12

SITE/SYSTEM DESCRIPTION:
THE CHESTER WEST SITE IS A THREE-BEDROOM TWO-STORY SINGLE FAMILY DWELLING OF APPROXIMATELY 2300 SQUARE FEET OF LIVING AREA. THE SOLAR SYSTEM USES ROOF MOUNTED FLAT PLATE COLLECTORS. A MIXTURE OF ANTIFREEZE AND WATER SERVES AS THE COLLECTOR-TO-STORAGE HEAT TRANSPORT FLUID. HEAT STORAGE IS A 500 GALLON TANK OF WATER LOCATED IN THE GARAGE. THE SOLAR SYSTEM SERVICES DHW PREHEAT AND SPACE HEATING NEEDS OF THE DWELLING FROM STORAGE ONLY. AUXILIARY SPACE HEATING IS PROVIDED BY A HEAT PUMP AND RESISTANCE HEATING COMBINATION.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	8.011 MILLION BTU
	3560G BTU/SQ.FT.
COLLECTED SOLAR ENERGY	3.802 MILLION BTU
	1698 BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	45 DEGREES F
AVERAGE BUILDING TEMPERATURE	70 DEGREES F
ECSS SOLAR CONVERSION EFFICIENCY	*
ECSS OPERATING ENERGY	0.216 MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	0.899 MILLION BTU
TOTAL ENERGY CONSUMED	10.234 MILLION BTU

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	*	6.050	N.A.	* MILLION BTU
SOLAR FRACTION	*	19	N.A.	* PERCENT
SOLAR ENERGY USED	*	1.169	N.A.	* MILLION BTU
OPERATING ENERGY	0.177	0.505	N.A.	0.899 MILLION BTU
AUX. THERMAL ENERGY	0.458	4.982	N.A.	5.440 MILLION BTU
AUX. ELECTRIC FUEL	0.458	5.073	N.A.	5.532 MILLION BTU
AUX. FOSSIL FUEL	N.A.	N.A.	N.A.	N.A. MILLION BTU
ELECTRICAL SAVINGS	*	0.548	N.A.	* MILLION BTU
FOSSIL SAVINGS	N.A.	N.A.	N.A.	N.A. MILLION BTU

SYSTEM PERFORMANCE FACTOR: *

* DENOTES UNAVAILABLE DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT
OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978,
SOLAR/0004-78/18
READ THIS BEFORE TURNING PAGE

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: CHESTER WEST
REPORT PERIOD: DECEMBER,1978

SOLAR/1030-78/12

SITE/SYSTEM DESCRIPTION:
THE CHESTER WEST SITE IS A THREE-BEDROOM TWO-STORY SINGLE FAMILY DWELLING OF APPROXIMATELY 2300 SQUARE FEET OF LIVING AREA. THE SOLAR SYSTEM USES ROOF MOUNTED FLAT PLATE COLLECTORS. A MIXTURE OF ANTIFREEZE AND WATER SERVES AS THE COLLECTOR-TO-STORAGE HEAT TRANSPORT FLUID. HEAT STORAGE IS A 500 GALLON TANK OF WATER LOCATED IN THE GARAGE. THE SOLAR SYSTEM SERVICES DHW PREHEAT AND SPACE HEATING NEEDS OF THE DWELLING FROM STORAGE ONLY. AUXILIARY SPACE HEATING IS PROVIDED BY A HEAT PUMP AND RESISTANCE HEATING COMBINATION.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	8.452 GIGA JOULES
	404350 KJ/SQ.M.
COLLECTED SOLAR ENERGY	4.011 GIGA JOULES
	191900 KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	7 DEGREES C
AVERAGE BUILDING TEMPERATURE	21 DEGREES C
ECSS SOLAR CONVERSION EFFICIENCY	N.A.
ECSS OPERATING ENERGY	0.228 GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	0.949 GIGA JOULES
TOTAL ENERGY CONSUMED	10.797 GIGA JOULES

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	*	6.382	N.A.	* GIGA JOULES
SOLAR FRACTION	*	19	N.A.	* PERCENT
SOLAR ENERGY USED	*	1.233	N.A.	* GIGA JOULES
OPERATING ENERGY	0.186	0.533	N.A.	0.949 GIGA JOULES
AUX. THERMAL ENG	0.483	5.256	N.A.	5.739 GIGA JOULES
AUX. ELECTRIC FUEL	0.483	5.352	N.A.	5.836 GIGA JOULES
AUX. FOSSIL FUEL	N.A.	N.A.	N.A.	N.A. GIGA JOULES
ELECTRICAL SAVINGS	*	0.578	N.A.	* GIGA JOULES
FOSSIL SAVINGS	N.A.	N.A.	N.A.	N.A. GIGA JOULES

SYSTEM PERFORMANCE FACTOR: *

* DENOTES UNAVAILABLE DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: CHESTER WEST
REPORT PERIOD: DECEMBER, 1978

SOLAR/1030-78/12

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	0.340	45	*	N	0.009	N	*
2	0.370	54	*	O	0.010	O	*
3	0.038	64	*	T	0.000	T	*
4	0.036	46	*		0.000		*
5	0.463	40	*	A	0.012	A	*
6	0.440	50	*	P	0.012	P	*
7	0.057	63	*	P	0.000	P	*
8	0.046	66	*	L	0.001	L	*
9	0.027	29	*	I	0.000	I	*
10	0.415	26	*	C	0.011	C	*
11	0.598	33	*	A	0.016	A	*
12	*	*	*	B	*	R	*
13	0.417	41	*	L	0.011	L	*
14	0.447	34	*	E	0.011	E	*
15	0.359	43	*		0.009		*
16	0.002	47	*		0.000		*
17	0.478	38	*		0.012		*
18	0.053	43	*		0.000		*
19	0.014	62	*		0.000		*
20	0.053	66	*		0.001		*
21	0.459	41	*		0.012		*
22	0.458	37	*		0.012		*
23	0.239	41	*		0.008		*
24	0.007	45	*		0.000		*
25	0.454	38	*		0.012		*
26	0.431	40	*		0.012		*
27	0.314	32	*		0.011		*
28	0.481	39	*		0.012		*
29	0.160	43	*		0.005		*
30	0.023	42	*		0.000		*
31	0.058	57	*		0.001		*
SUM	8.011	-	*	N.A.	0.216	N.A.	-
AVG	0.258	45	*	N.A.	0.006	N.A.	*
NBS ID	Q001	N113			Q102		N111

* DENOTES UNAVAILABLE DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: CHESTER WEST
REPORT PERIOD: DECEMBER,1978

SOLAR/1030-78/12

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	0.340	0.307	0.163	54	0.479
2	0.370	0.351	0.185	58	0.499
3	0.038	0.000	0.000	67	0.000
4	0.036	0.000	0.000	45	0.021
5	0.463	0.439	0.236	46	0.509
6	0.440	0.423	0.226	57	0.513
7	0.057	0.008	0.006	64	0.110
8	0.046	0.011	0.008	75	0.174
9	0.027	0.000	0.000	28	0.000
10	0.415	0.394	0.220	35	0.530
11	0.598	0.566	0.302	44	0.506
12	*	*	*	*	*
13	0.417	0.389	0.211	54	0.506
14	0.447	0.418	0.218	42	0.488
15	0.359	0.328	0.178	51	0.497
16	0.002	0.000	0.000	50	0.000
17	0.478	0.461	0.247	46	0.518
18	0.053	0.002	0.001	47	0.028
19	0.014	0.000	0.000	61	0.000
20	0.053	0.016	0.011	69	0.219
21	0.459	0.443	0.235	45	0.512
22	0.458	0.438	0.234	49	0.511
23	0.239	0.205	0.103	48	0.431
24	0.007	0.000	0.000	45	0.000
25	0.454	0.434	0.231	45	0.509
26	0.431	0.408	0.221	51	0.513
27	0.314	0.287	0.141	39	0.451
28	0.481	0.458	0.229	44	0.477
29	0.160	0.113	0.057	46	0.355
30	0.023	0.000	0.000	42	0.000
31	0.058	0.009	0.006	60	0.117
SUM	8.011	7.151	3.802	-	-
AVG	0.258	0.230	0.122	50	0.475
NBSID	Q001		Q100		N100

* DENOTES UNAVAILABLE DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCE

SITE:CHESTER WEST
REPORT PERIOD:DECEMBER,1978

SOLAR/1030-78/12

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	0.150	*	0.097	105	*
2	0.169	*	0.026	111	*
3	0.000	*	-0.101	100	*
4	0.000	*	-0.048	99	*
5	0.217	*	0.108	103	*
6	0.208	*	0.038	106	*
7	0.005	*	-0.127	94	*
8	0.007	*	0.001	88	*
9	0.000	*	-0.018	86	*
10	0.203	*	0.011	94	*
11	0.281	*	0.177	98	*
12	*	*	*	*	*
13	0.195	*	-0.001	106	*
14	0.203	*	-0.045	104	*
15	0.164	*	0.015	101	*
16	0.000	*	-0.088	84	*
17	0.230	*	0.144	104	*
18	0.001	*	-0.158	90	*
19	0.000	*	-0.006	81	*
20	0.010	*	0.006	82	*
21	0.217	*	0.064	101	*
22	0.218	*	0.030	104	*
23	0.095	*	-0.078	93	*
24	0.000	*	-0.021	83	*
25	0.212	*	0.117	103	*
26	0.207	*	-0.016	105	*
27	0.130	*	-0.094	92	*
28	0.213	*	0.060	101	*
29	0.050	*	-0.034	86	*
30	0.000	*	-0.023	87	*
31	0.006	*	-0.005	82	*
SUM	3.516	*	0.049	-	-
AVG	0.113	*	0.001	96	*
NBS ID	Q200	Q201	Q202		N108

* DENOTES UNAVAILABLE DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
HOT WATER SUBSYSTEM

SITE:CHESTER WEST
REPORT PERIOD:DECEMBER,1978

SOLAR/1030-78/12

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR FR.OF LOAD PER.	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	0.000	*	*	0.005	0.010	0.010	N	*	N	67	140	0
2	0.008	*	*	0.009	0.010	0.010	O	*	O	72	140	15
3	0.001	*	*	0.009	0.008	0.008	T	*	T	73	140	2
4	0.004	*	*	0.000	0.016	0.016		*		64	140	6
5	*	*	*	0.009	0.014	0.014	A	*	A	56	140	*
6	*	*	*	0.011	0.012	0.012	P	*	P	56	140	*
7	*	*	*	0.008	0.008	0.008	P	*	P	56	140	*
8	*	*	*	0.000	0.009	0.009	L	*	L	56	140	*
9	*	*	*	0.002	0.030	0.030	I	*	I	56	140	*
10	*	*	*	0.007	0.022	0.022	C	*	C	55	140	*
11	0.000	*	*	0.011	0.009	0.009	A	*	A	61	140	0
12	*	*	*	*	*	*	B	*	B	*	*	*
13	0.001	*	*	0.010	0.009	0.009	L	*	L	63	140	2
14	0.003	*	*	0.011	0.010	0.010	E	*	E	65	140	6
15	*	*	*	0.009	0.022	0.022		*		60	140	*
16	*	*	*	0.000	0.013	0.013		*		59	140	*
17	*	*	*	0.007	0.020	0.020		*		59	140	*
18	*	*	*	0.009	0.019	0.019		*		59	140	*
19	0.001	*	*	0.000	0.012	0.012		*		66	140	2
20	0.006	*	*	0.000	0.011	0.011		*		70	140	11
21	0.000	*	*	0.007	0.014	0.014		*		61	140	0
22	*	*	*	0.011	0.025	0.025		*		48	140	*
23	*	*	*	0.008	0.012	0.012		*		48	140	*
24	*	*	*	0.000	0.010	0.010		*		48	140	*
25	*	*	*	0.004	0.010	0.010		*		48	140	*
26	*	*	*	0.004	0.009	0.009		*		48	140	*
27	*	*	*	0.001	0.010	0.010		*		48	140	*
28	*	*	*	0.004	0.009	0.009		*		48	140	*
29	*	*	*	0.000	0.009	0.009		*		50	140	*
30	0.008	*	*	0.002	0.020	0.020		*		60	140	12
31	*	*	*	0.003	0.038	0.038		*		60	140	*
SUM	*	-	*	0.177	0.458	0.458	N.A.	*	N.A.	-	-	*
AVG	*	*	*	0.005	0.014	0.014	N.A.	*	N.A.	58	140	*
NBS	Q302	N300	Q300	Q303	Q301	Q305	Q306	Q311	Q313	N305	N307	N308

* DENOTES UNAVAILABLE DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE HEATING SUBSYSTEM

SITE: CHESTER WEST
REPORT PERIOD: DECEMBER, 1978

SOLAP/1030-78/12

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR.OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG TEMP DEG. F	AMB TEMP DEG. F
1	0.161	9	0.013	0.011	0.151	0.154	N	0.005	N	70	45
2	0.048	100	0.048	0.011	0.000	0.000	O	0.017	O	70	54
3	0.029	100	0.029	0.006	0.000	0.001	T	0.010	T	71	64
4	0.115	15	0.017	0.010	0.100	0.102		0.006		71	46
5	0.194	14	0.026	0.013	0.170	0.172	A	0.010	A	71	40
6	0.079	73	0.058	0.018	0.022	0.022	P	0.022	P	72	50
7	0.057	100	0.056	0.015	0.000	0.000	P	0.019	P	71	63
8	0.000	0	0.000	0.000	0.000	0.000	L	0.000	L	74	66
9	0.587	0	0.000	0.027	0.600	0.611	I	0.000	I	70	29
10	0.378	17	0.065	0.028	0.318	0.323	C	0.037	C	70	26
11	0.325	6	0.019	0.020	0.310	0.315	A	0.009	A	70	33
12	*	*	*	*	*	*	B	*	B	*	*
13	0.126	59	0.074	0.019	0.055	0.058	L	0.037	L	69	41
14	0.215	44	0.094	0.025	0.127	0.132	E	0.051	E	70	34
15	0.175	32	0.056	0.019	0.121	0.124		0.025		70	43
16	0.167	20	0.033	0.017	0.135	0.136		0.011		70	47
17	0.181	0	0.000	0.008	0.184	0.187		0.000		71	38
18	0.224	28	0.063	0.023	0.162	0.164		0.033		69	43
19	0.061	0	0.000	0.002	0.060	0.063		0.000		70	62
20	0.000	0	0.000	0.000	0.000	0.000		0.000		71	66
21	0.102	48	0.049	0.011	0.054	0.054		0.026		70	41
22	0.180	34	0.061	0.019	0.121	0.124		0.033		70	37
23	0.180	39	0.069	0.024	0.112	0.115		0.032		68	41
24	0.283	1	0.003	0.014	0.284	0.289		0.001		67	45
25	0.177	16	0.027	0.011	0.152	0.154		0.014		67	38
26	0.108	77	0.082	0.019	0.026	0.026		0.041		67	40
27	0.191	47	0.090	0.028	0.102	0.104		0.049		67	32
28	0.283	19	0.054	0.019	0.232	0.235		0.020		67	39
29	0.456	7	0.033	0.028	0.431	0.439		0.012		67	43
30	0.571	0	0.000	0.024	0.589	0.601		0.000		71	42
31	0.188	0	0.000	0.008	0.189	0.192		0.000		71	57
SUM	6.050	-	1.169	0.505	4.982	5.073	N.A.	0.548	N.A.	-	-
AVG	0.195	19	0.037	0.016	0.160	0.163	N.A.	0.017	N.A.	70	45
NBS	Q402	N400	Q400	Q403	Q401		Q410	Q415	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

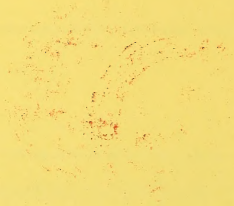
MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE:CHESTER WEST
REPORT PERIOD:DECEMBER,1978

SOLAR/1030-78/12

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	1512	N	45	54	N	N	N
2	1649	O	54	58	O	O	O
3	172	T	64	67	T	T	T
4	164		46	45			
5	2060	A	40	46	A	A	A
6	1958	P	50	57	P	P	P
7	254	P	63	64	P	P	P
8	207	L	66	75	L	L	L
9	121	I	29	28	I	I	I
10	1848	C	26	35	C	C	C
11	2659	A	33	44	A	A	A
12	*	B	*	*	B	B	B
13	1855	L	41	54	L	L	L
14	1989	E	34	42	E	E	E
15	1598		43	51			
16	13		47	50			
17	2126		38	46			
18	237		43	47			
19	64		62	61			
20	237		66	69			
21	2044		41	45			
22	2037		37	49			
23	1064		41	48			
24	32		45	45			
25	2021		38	45			
26	1919		40	51			
27	1396		32	39			
28	2141		39	44			
29	713		43	46			
30	106		42	42			
31	262		57	60			
SUM	35607	N.A.	-	-	-	-	-
AVG	1149	N.A.	45	50	N.A.	N.A.	N.A.
NBS ID	0001		N113			N115	N114

* DENOTES UNAVAILABLE DATA.
N.A. DENOTES NOT APPLICABLE DATA.



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